

This lesson is part of a larger, comprehensive school garden guide called **Minnesota School Gardens: A Guide to Gardening and Plant Science** developed by Minnesota Agriculture in the Classroom in 2013. The entire guide is available at [www.mda.state.mn.us/maitc](http://www.mda.state.mn.us/maitc).



## Grade

Elementary K-5

### Materials/Preparation

- ☐ Handout A – Make Room for Raddy Problem Solving – one per student
- ☐ Newsprint/drawing paper
- ☐ Notebook paper
- ☐ Crayons
- ☐ Masking tape
- ☐ Raisins (optional)
- ☐ Radish seeds
- ☐ Pots for planting seeds
- ☐ Potting mix
- ☐ Grow lights (optional)
- ☐ Writing instruments

### Fun Fact

Members of the nightshade family, tomatoes are close cousins with chili peppers, potatoes, and eggplants.



# Make Room for Raddy

## Minnesota K-12 Academic Standards

<b>Science</b>	<b>1.1.1.1</b> <b>3.1.1.1</b> <b>5.1.1.1</b>	Scientists work as individuals and groups to investigate the natural world, emphasizing evidence and communicating with others.
<b>Science</b>	<b>2.1.1.2</b> <b>3.1.1.2</b> <b>5.1.1.2</b>	Scientific inquiry is a set of interrelated processes incorporating multiple approaches that are used to pose questions about the natural world and investigate phenomena.
<b>Science</b>	<b>2.4.2.1</b>	Recognize that plants need space, water, nutrients and air, and that they fulfill these needs in different ways.
<b>Language Arts</b>	<b>3.6.7.7</b>	Conduct short research projects that build knowledge about a topic.
<b>Language Arts</b>	<b>4.6.7.7</b>	Conduct short research projects that build knowledge through investigation of different aspects of a topic.
<b>Language Arts</b>	<b>5.6.7.7</b>	Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic.

## Summary/Overview

Students observe how plants and people respond when crowded and forced to share limited resources. This activity helps students understand that even their precious garden plants must sometimes be thinned.

## Garden Connection

Students learn that seedlings often need to be thinned in order to receive enough nutrients and sunlight.

## Background Information

Like all living things, green plants have basic needs. If light, water, air, nutrients, and an adequate temperature range are not available, plants cannot thrive and grow. Overcrowding causes competition for limited resources and limits the ability of individual plants to meet basic needs. Too much of a good thing can be as harmful as too little. An excess of fertilizer, for instance, can cause plant cells to grow too quickly, resulting in weak or dead plants. Too much water can prevent necessary oxygen from reaching roots.

In this lesson, students grow radishes to observe what happens when plants are overcrowded. For good root development of radishes grown indoors, keep lights within two to three inches of the plants and have students pile more soil mix around the base of the plants as radishes grow.

The crowded radishes may look stunted and pale from competing for necessary nutrients and water. Sometimes crowded plants actually look taller ("leggier") as they compete for light. Radishes in a crowded situation, however, are less likely to develop the large food storage roots that we eat.

## Objectives

- To experience and reflect on the limitations of a crowded situation.
- To conduct an experiment to examine how radishes respond to crowding.
- To infer that overcrowding affects the ability of living things to meet basic needs.

## Procedure

### Interest Approach

Divide your class into an even number of small groups, with a maximum of eight students per group. Ask each group to draw a mural showing plants growing in a garden. Give half of the groups the following resources:

- A long sheet of drawing paper
- Enough crayons for each student
- A snack of raisins with plenty to go around (optional)
- A large area in which to draw
- Five minutes time to complete the drawing

Here is the twist: ask the remaining group(s) each to work in a 4 by-4- foot square taped on the floor, and give them a shortage of resources:

- One very small sheet of drawing paper
- A couple of small crayons
- A couple of raisins for snacking (optional)
- Limited space
- Three minutes to complete the drawing

After the allotted time, ask members from each group to show and describe their drawings to the rest of the class. Ask each group how they felt about the drawing experience. Ask if they had any problems and if so, what were they? Ask the class what was different about the two groups' experiences.

Help the groups focus on the contrast between having limited resources and plenty of resources. Besides a lack of space, what else did students notice was in short supply? Ask students what might happen if they never got enough of what they needed? Ask how a lack of space might affect plants and why.

## Summary of Content and Teaching Strategies

As a class or in small groups, discuss how you might set up an investigation to test the effects of crowding on radish plants. Use Handout A to guide the investigation. Have students record predictions comparing the growth and appearance of radishes in the pots. As the experiment progresses, students continue to record their observations in words or drawings on notebook paper. After four or five weeks, dig up radishes to compare and record root development.

If different groups set up experiments, make a class chart to compare observations. Review observations as a class. Ask students what they notice about the plants in each pot. Which pot seemed to have the healthiest plants? How did you decide if they were healthier? Which pot had the tallest plants? Did they look healthier? How did these compare to your predictions? What was the biggest difference between the radishes in the three pots?

Use student findings to ask specific questions about the investigation. For instance, ask why students think

- ... the radishes were rounder in the less crowded pot?
- ...the leaves in the more-crowded pot turned yellow?
- ...there was not much difference in the radishes in Pots A and B?

## Review/Summary

Review the following questions with the class:

1. How was what happened in your “mural” challenge similar to what happened to the radishes in the crowded pot?
2. Do you think you would have felt crowded if you had had enough paper and crayons?
3. What are some other situations in which crowding can be a problem for people, animals, or plants?
4. Would we have learned as much if we had planted only one pot of crowded radishes? Why?
5. What are some other ways we could set up an investigation to test the effects of crowding on plants?

## Modifications/Extensions

Plant seeds in several pots. Place dividers between the seeds and give each section its own nutrients and water. Examine whether this can compensate for overcrowding.

Develop a progressive story about an overcrowded situation involving people or plants. One student begins the story and passes it on for continuation to the next student, and so on.



### Sources/Credits

Adapted from the National Gardening Association's *Grow Lab Activities for Growing Minds*, second edition, copyright 2009. For information on obtaining a copy of their curriculum, visit [www.gardeningwithkids.org](http://www.gardeningwithkids.org).



Name \_\_\_\_\_



# Make Room for Raddy Problem Solving

Use these two pages to guide you through  
the stages of problem solving.

Hmmm, I wonder  
what will happen if...

## Plant a Question

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I think... the more  
I water plants, the  
faster they'll grow.

## Sprout a Hypothesis

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## Describe Your Growing Exploration:

What steps will I take to find the answer?

Let's see... what materials will I need?

Oh, I need to remember to change only one factor and keep the others constant!

What will I observe? How often?

Which is the control group?

Did I remember repetition? Did I remember repetition?

## Record Fruitful observations

(attach all record sheets)

## Harvest Your Findings

What happened?  
How can I explain  
it?

## Ongoing Review

What else could  
have affected my  
results?

Oops, maybe I  
should be more  
careful about...

## Cultivating New Ideas

Next time, I'm  
going to...

This makes  
me wonder  
about...

I still have  
questions  
about...

Now I would  
like to try...